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The impact of business innovation modes on SME innovation performance in post-Soviet transition economies: The case of Belarus

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ABSTRACT

This study analyzes the most effective innovation modes ('science and technology-based innovation', STI, and 'doing, using and interacting-based innovation', DUI) for business innovation performance in the context of post-Soviet Transition Economies (PSTE). Their specificities are expected to influence both their business innovation modes and their impact on innovation output. In particular, we aim at identifying the specificities of PSTE in that the DUI mode alone (and its specific drivers) is more relevant than the STI mode alone (and its drivers). In our hypothesis, this outcome should be even stronger in the context of non-technological types of innovation (e.g. organizational innovation).

1. Introduction

It is widely accepted that in a time of advanced technologies and greater flows of information, a firm's ability to innovate has become a central driver of growth, competitiveness and sustainability (OECD, 2013; GII, 2014; EU, 2014). Over the last thirty and odd years, SMEs have been regarded as a driving force of innovation and economic performance due to their nimbleness and flexibility (Birch, 1981; Piore and Sabel, 1984; Audretsch, 2003; UNECE, 2011. Therefore, innovative SMEs are an important policy target for many governments. This paper aims at contributing knowledge on the modes of innovation employed by SMEs in the context of post-Soviet transition economies (PSTE). In particular, this study addresses the following research question: What is the most effective mode of innovation in PSTE? It is a rather unexplored research area in this strand of the literature that can help to identify and discuss possible country specificities, which may produce relevant implications for multi-level policy coordination and different policy mixes (Vitola, 2015).

The debate on STI/DUI modes of innovation has attracted interest among international scholars. However, the majority of in-country analyses on the modes of innovation have mainly focused on developed countries that operate in market economies (Apanasovich, 2014). These studies have shown that firms that combine STI and DUI modes of learning are more likely to innovate than those relying on the STI and DUI mode alone in Denmark, Norway and Sweden (Isaksen and Nilsson, 2013; Aslesen et al., 2012) and Canada (Amara et al., 2008). However, other studies developed in Spain, China (Chen et al., 2011), Portugal and Colombia (Malaver and Vargas, 2013) show more ambiguous results. This might lead to a context-specific adoption of innovation modes that we aim at exploring in further depth. In PSTE, studies that analyze the effect of modes of innovation on the performance of firms are absent, thus motivating this new research endeavor. The peculiarities of these countries are, on the negative side, the lack of financial capital, innovation management experience and state-of-the-art technology, while, on the positive side, a rather high level of educated human capital (Aidis, et al., 2008; Rees and Miazhevich, 2009; Fink, et al., 2009).

For the sake of completeness, in this paper, the impact of STI and DUI modes is studied not only on technological innovation (i.e. product and/or process innovation), but also on organizational innovation that represents a "non-technological" type of innovation. Yet, it is relevant for businesses that want to be competitive in current globalized markets. In addition, the methodology of measuring the DUI mode is enriched by adding new indicators that capture learning-by-doing and by-using drivers vis-à-vis most studies that focus and measure the learning-by-interaction driver alone.

For our empirical analysis, Belarus has been selected as a representative of PSTE as it displays most features in common within this group of countries (see Section 4). In this study, we exploited

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data of 489 Belarusian SMEs compiled by the National Statistical Committee of the Republic of Belarus (Belstat) collected through a locally-based community innovation survey's (CIS).

This paper is structured as follows. In section two the main streams of research focusing on the adoption of the STI and DUI modes of innovation are examined. In section three the concept of firm's innovation performance is discussed, whereas in section four the geographical focus (i.e. PSTE and Belarus) of our study is clarified. In section five, the core hypotheses are developed. In section six the sample, the selected methodology and the results of the econometric analysis are described. In the final sections, the novel study outcomes are summarized and the implications for SMEs and policy-makers are discussed.

2. The debate on the STI/DUI modes of innovation

The STI mode emphasizes the importance of scientific human capital and innovation infrastructure (e.g. public and private R&D organizations and universities). Following the seminal contribution produced by Jensen et al. (2007), human capital involves employees with a PhD in natural sciences or in construction engineering that are involved in innovation projects. Within this view, engineers working in other relevant areas (mechanics, electronics, chemistry) are considered in line with a DUI approach to innovation as their work is based mainly on synthetic knowledge rather than on analytical knowledge (Jensen et al., 2007). A high level of scientific education across the employees increases the firm's absorptive capacity and, consequently, improves the impact of R&D activities (Cohen and Levinthal, 1989; Herstad et al., 2015). The main partners of STI firms are researchers, universities and other research organizations. Although firm, sector and country specificities mediate a differentiated impact of R&D activities and policies, the general accumulation of scientific knowledge through R&D activities is recognized as a main source of increasing returns and a fundamental component of endogenous growth. This has also meaningful implications for policy-making, particularly in the context of complex national or federal systems in which the coordination of innovation policies, and the related policy mix takes place (Vitola, 2015).

The DUI mode of innovation is based on non-scientific drivers, namely learning-by-doing, learning-by-using and learning-by-interacting (Jensen et al., 2007). The learning-by-doing introduced by Arrow increases productivity by repeating the same manufacturing operations that lead to experiential learning advantages. Amara et al. (2008) relate learning-by-doing to production and non-production-based activities, such as promotion and marketing. Repeating market trials and promotion of new or improved goods and services help problem-solving. Rosenberg (1982) argues that learning from user experience and demand in customizing products contributes to innovation and productivity growth. In fact, the use of technologies, machines and equipment facilitates learning-by-using, e.g. acquiring competences by deploying relevant state-of-the-art technology. Interaction with external organizations conduces to the development of innovations (Lundvall, 1988; Ritter and Gemünden, 2004; Fitjar and Rodriguez-Pose, 2013; Alcalde Heras, 2014; Bengtsson and Johansson, 2014). The need to find a solution to specific problems and to respond to specific requests propels SMEs to adopt this type of innovation process (i.e. DUI). The knowledge is often generated from trial-and-error processes, shared mainly through tacit knowledge flows. The STI and DUI modes of innovation are rarely found in pure forms in specific industries; however, industries can be dominated by either the STI or the DUI mode (Chen et al., 2011; Isaksen and Karlsen, 2012a). For example, pharmaceutical and chemical manufacturing industries are dominated by the STI mode, while machine-tools, cars, textiles, furniture and mechanical engineering are industries in which the DUI mode is widespread.

A third mode of innovation is identified as the combination of STI and DUI modes of innovation. Within this approach, firms that used one mode intensively may benefit from paying more attention to the other. In the context of Denmark, Jensen et al. (2007) argue that firms that combine the STI with DUI modes are more innovative. More recent studies by Aslesen et al., Isaksen and Karlsen, Herstad et al. (2015), and Isaksen and Nilsson (2012) on Norway and Sweden, and Amara et al. (2008) on Canada confirm Jensen et al.'s results (2007). On the contrary, based on empirical evidence from Spain, Parrilli and Elola (2012) and González et al. (2012), and from Colombia, these scholars argue that innovation output (i.e. product innovation) is in fact more sensitive to STI drivers than to DUI drivers, at least for product innovation. Other studies display more nuanced results. For instance, some industries seem to be more inclined to benefit from a combined approach to innovation (high-tech industries in China) while others seem to benefit mostly from DUI drivers, i.e. low tech industries in China (Chen et al., 2011). In the context of Portugal, Nunes et al. (2013) developed a latent cluster analysis that shows the existence of three groups of firms (i.e. low learners, moderate DUI innovators and stronger STI-DUI innovators). It is the third type the one that implements innovation to a significant extent, whereas the other two groups, only focused on DUI innovation, are not capable of producing significant innovation output.

This set of contrasting results sheds light on a novel interpretation of the most fruitful innovation modes across countries. In particular, there may be a sort of country-specific propensity to a certain business innovation mode (Parrilli et al., 2016). The countries that combine successfully STI and DUI innovation modes tend to be very advanced countries (e.g. Scandinavian countries). Countries at a lower development level might find it hard to combine positively the two modes (at least across all industries). This might depend on some country specificities and/or weaknesses, e.g. the more reduced education rate across the population and the poor infrastructures in these other countries vis-à-vis Scandinavian countries that benefit from higher business connectivity and competences and skills standards (the EU context in which most studies on STI and DUI innovation modes have been developed). These aspects are going to be further explored in the case of PSTE, a type of countries that has not been taken in consideration in recent studies.

3. Innovation performance

In order to measure the effect of the different modes of innovation we take into account measures of innovation performance. Following the OECD Oslo Manual for Innovation (OECD, 2005), the idea of innovation is widened to include not only product and process innovation (i.e. 'technological innovation'), but also softer, 'non-technological' innovation, e.g. commercial and organizational (OECD, 2005; Lam, 2005; Stoneman, 2010). This conceptualization permits emphasizing the possibility to invest in innovation without disbursing significant amount of resources for R&D and innovation infrastructures, while investing more in a wider set of human resources (e.g. managers, designers, marketing experts, consultants, technicians) that contribute rich inputs to the innovation process.

In this study, we focus on two types of innovation output, 'technological' and 'non-technological'. Within the first category product innovation is considered, which is available within the database exploited in this study. Instead, process innovation was hardly available. The data provided by Belstat had a lot of missing observations needed to construct the indicators of process innovation. In spite of this limitation, our research continued based on the consideration that data on product innovation represent adequately the business behavior and performance in technological innovation. Within the second category of innovation output, organizational innovation was

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